Effect of Soil Properties and Environmental Conditions on the residual Gasoline and Gasoline components volume under ground

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Petroleum hydrocarbons and organic solvents are one of the major contaminants in the groundwater and the soil environment. Mineral oil such as gasoline, kerosene, light oil, and heavy oil have not been investigated or cleaned up enough because they had not been thought to be as contaminant in Japan. However, risk and exposure assessment of mineral oil for soil and groundwater environment are very important for both aspects of health and environmental protection as well as making decision of remedial goal for engineering activities, recently.

Mineral oil is a mixture of a lot of hydrocarbon compounds. And, each component has different risks for human health. So, it is need to collect the knowledge and basic data of mineral oil movement and residual volume in soil. In general, the components of small hydrocarbon number have high volatility, on the other hand, the components of big hydrocarbon number tend to be stayed in soil because of their low volatility. But, carbon number is not the only cause that brings risk on human health. Mineral oil is also classified into PONA (paraffin, olefin, naphthene, and aroma) according to their chemical construction. Aromatic compounds include toxicity components. However, the conditions that influenced the state and movement of mineral oil and their components have not been investigated enough. Therefore, it is important to show their movement and residual volume in soil.

In this study, we studied the residual gasoline ratio and the ratio of residual gasoline components in the subsurface environment to understand the fate of gasoline under ground. A set of batch experiments were carried out understanding the effect of soil properties and environmental condition on the residual gasoline ratio and the residual gasoline components ratio. Specifically, we show the relation between the gasoline residual ratio and the three environmental factors such as temperature, soil water contents, and soil organic matter contents.

We set three types of temperature, 4.0, 15.0, 30.0C for clear the relation between temperature and gasoline residual ratio in soil. And four types of soil water contents (0.00, 0.05, 0.10, and 0.20) were set for study the effect of soil water contents to the gasoline residual ratio. Further, four kinds of soils were used to understand the relation between the gasoline residual ratio and soil organic matter contents. We simulated the contaminant soil with introduced the gasoline into clean soils. Carbon disulfide was used to extract the residual gasoline from soil. Total petroleum hydrocarbon (TPH) was analyzed with GC-FID (GC-2014), and PONA components were analyzed with GC-FID (GC-2010) that installed the PONA fractionation appurtenances.

As a result, the temperature was not correlated with the residual gasoline ratio, while the amount of organic matter containing in the soil was correlated with it. Especially, the residual gasoline ratio was high in the soil that contained a lot of organic matter. Their relation might be in proportion. The weight of water content and the residual gasoline ratio was not in proportional relation. But, when the water content was high, the residual gasoline ratio was high. Otherwise, the residual ratio of gasoline components that were PONA (paraffin, olefin, naphthene, and aroma) was not influenced by the amount of organic compounds. But the hydrocarbon number of residual gasoline components was related to the volume of soil organic contents. Additionally, C6-aroma that would be regarded as high risk component for human health tends to be remained in soil under any circumstances.